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ABSTRACT

The design of computer materials for self-directed language learning is discussed from two points of view: (1) adaptability or flexibility of computer materials; and (2) the potential and limitations of computer-assisted instruction for enhancing autonomous learning. Important considerations in designing flexible materials through careful programming are discussed, including the need to assess differing learner needs and abilities, address them, and provide feedback appropriate to the individual's performance. Examples are offered from computer programs currently available or in development. Discussion of the issue of self-direction in language learning draws on recent research on this form of learning, and on the construction and sequencing of learning modules within a program. Again, examples are offered. It is concluded that while computer-assisted language learning can benefit from what has already been accomplished in programming and materials design, both within and outside the field of language instruction, there is a need for much more research into the concept and construction of intelligent tutorial systems and self-directed language learning, especially as the technology advances. A brief list of references is included. (MSE)

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Self-Directed Learning and New Technologies: Computers as Language Learning Tools

Bernd Ruschoff

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SELF-DIRECTED LEARNING AND NEW TECHNOLOGIES: COMPUTERS AS LANGUAGE LEARNING TOOLS

Bernd Ruschoff

I INTRODUCTION

When discussing the problem of computer assisted language learning (CALL) materials for individual study, scholars often look back at the first (mainframe-based) phase of using computers as learning and teaching aids. In view of some of the "newly" developed drill and practice software as well as the many problems language teachers have had with technical media, this is often enough a look back in anger. However, while the principles of behaviouristic programmed learning (PL) or instruction (PI) should not be revived when developing CALL programmes for microcomputers, some of the earlier ideas concerning branching techniques and adaptivity etc should at least be reexamined.

Most programmes available to date use branching mainly on a one-to-one basis, even though in the past it has often been pointed out that it is not sufficient to use branching purely on the basis of a student's performance when dealing with an isolated task, but that the complete history of the student-program dialogue would have to be taken into consideration. (cf Eyferth, 1974) Furthermore, self-determination and the need for learners to take charge of their learning in a responsible way have become important features of language learning in recent years. Therefore, I intend to address myself to two important aspects to be considered when devising computer assisted self-study packages for language learning.

First, I shall further elaborate on the concept of adaptivity in CALL materials, which I have discussed on previous occasions. (cf Ruschoff, 1986) sufficient flexibility and adaptivity can only be achieved if such programmes in addition to providing a meaningful input analysis are able to collect information about the learning history and performance of individual learners and to interpret it intelligently. Two possible applications of this idea will be presented: the possibility of a permanent needs/performance analysis while a learner is working with a given programme, and a pre-exercise needs analysis, possibly on the basis of a pre-test. The resulting changes and adaptations in either course or content of a programme could be initiated automatically, but the importance and possible advantages of letting each learner participate in such decisions and thus giving him/her a measure of control are to be considered as well.

Consequently, the second aspect I want to present here will be an initial analysis of the possibilities (and limitations) of computers enhancing autonomous (language) learning. With regard to this problem, I intend to argue that self-study packages have to be put together in such a way that they take into account the fact that different learners have different levels of learning experience resulting in a difference of learning styles and learning proficiency. After the early stages of an exercise package, where the programme on behalf of an inexperienced learner "decides" more or less exclusively on course and content, such packages could in my opinion allow for a growing degree of self-determination as a learner progresses. However, this has to be organized in a way which gradually enables a learner to take more and more responsibility for his/her learning. That is to say, in addition to a flexible exercise path, a meaningful input analysis and calculation of an individual learner's performance, a CALL programme should also incorporate various strategies for gradually individualizing the learner in order to make him/her autonomous in the sense of becoming capable of self-instruction and self-direction as defined by Little and Grant (1986).

However, when I talk of individualization I am not referring to the kind of complete individualization of learning as proposed and investigated throughout the seventies. The strategies I would like to see incorporated in CALL programmes for individual study are aimed at improving a learner's ability to make the best use of self-study phases within a curriculum. It is my opinion that because of the specific communicative nature of the subject language complete individualization is a concept not applicable to language learning. Nevertheless, the theories and findings of research dealing with so-called "intelligent" tutorial systems as well as self-directed learning in general definitely deserve a closer inspection by developers of CALL programmes as to their applicability for language learning software for self-study. (for further information on these areas see Unterrichtswissenschaft 4, 1986: special issue on "Lernen mit dem Computer" and Caffarella and O'Donnel, 1987).

The ideas I am going to present in this paper are admittedly somewhat theoretical, as most of the CALL software developed for individual study tends to be more of the "masterial" rather than the "pedagogical" type as defined by John Higgins (1983). What I am about to discuss is based on observing students and schoolchildren as well as adult learners working with various kinds of CALL materials as well as consulting the literature dealing with "intelligent" tutorials and self-directed learning. Though the observations where not conducted in any empirical way, it was interesting to see how learners reacted to various levels of flexibility.

The main conclusion was that, apart from getting frustrated with programmes that treat input in an insufficient and simplistic manner, learners seem to feel the need to be allowed to influence the way they have to work with a programme.

They want to be able to decide for themselves between varying degrees of help and feedback and to ask the programme for further information when they feel it is necessary. They want to be able to interrupt an exercise and return to it at a later stage as well as to be allowed to flip back and forth in an exercise and to check on their work on previous tasks in the programme. Many more observations could be listed here, but due to the limited scope of this paper I shall now concentrate on describing some of my deliberations concerning flexibility, adaptivity and self-directedness as well as a few examples of the software we have developed at the AVMZ.

II FLEXIBILITY AND ADAPTIVITY

Since the earliest days of (language) learning teachers have been faced with the problem of differing levels of competence and different styles of learning within any one group of learners. Learners are individuals, and the past has shown that in order to really be able to cope with these differences between learners when working individually, a teacher would ideally have to provide each and every one of them with customized self-study materials. Consequently, if one browses through the shelves of an educational bookshop, one will find a vast variety of printed materials for individual learning, often with accompanying AV-tapes, addressing themselves in different ways to problems such as vocabulary building, general grammar, revision, sentence construction, reading and listening comprehension etc...

Traditionally, self-study CALL programmes were simply computer programmed versions of previously existing paper-based exercise materials, the only benefit being that a learner immediately discovered whether his/her response to a given task was corrent or not. As far as the input analysis of most of these types of "drill and practice" programmes is concerned, all too often the word analysis does not properly describe the simplicity and sometimes even stupidity of such materials. However, I shall not go into further details with regard to the need for intelligently programmed input analysis routines in CALL packages, as this problem has already been discussed by many of my CALLeages (sic) and myself in the past.

Furthermore, increasing amounts of the more recently developed materials seem to have been equipped with a higher degree of "intelligence" than their predecessors when it comes to their ability to treat students' input in a productive and constructive way. Returning, however, to the problem of individual learners' needs, it is in my opinion of equal importance to allow for a certain degree of flexibility in the structure and sequence of CALL programmes. To achieve a degree of adaptivity, I do not think that it is necessary to create an expert system or some other form of artificial intelligence. Such programmes

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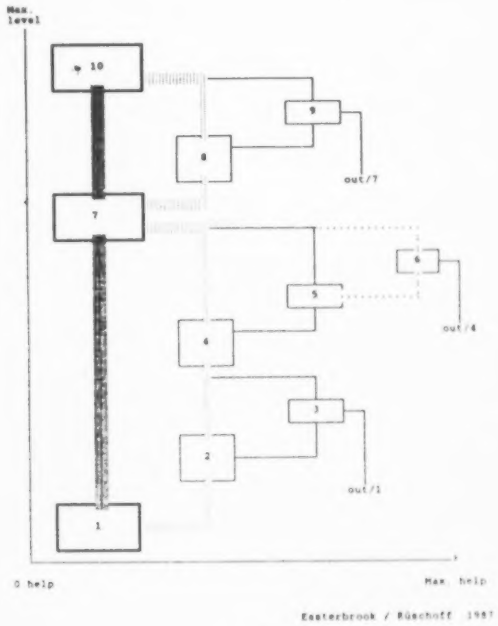
would only need "to know" enough about the language problem in question to be able to perform a meaningful error-analysis. In addition to this they would have to have the capability of collecting relevant information on an individual learner's learning style and performance to be able to reprogram themselves in a way which ensures that they constantly suit his/her needs and further concentrate on areas of particular difficulty.

Ideally, and of course hypothetically, one could put all the different existing materials dealing with a particular set of language problems with all their different types of exercise forms and learning strategies and their varying degrees of help and feedback provided by the programme into one big package. Which of these exercises an individual learner will have to work with and which switches in course and/or content will take place while the programme runs would depend on a coefficient calculated by the programme and reflecting a particular learner's needs and/or performance. (cf Marty, 1982 and Ruschoff, 1986).

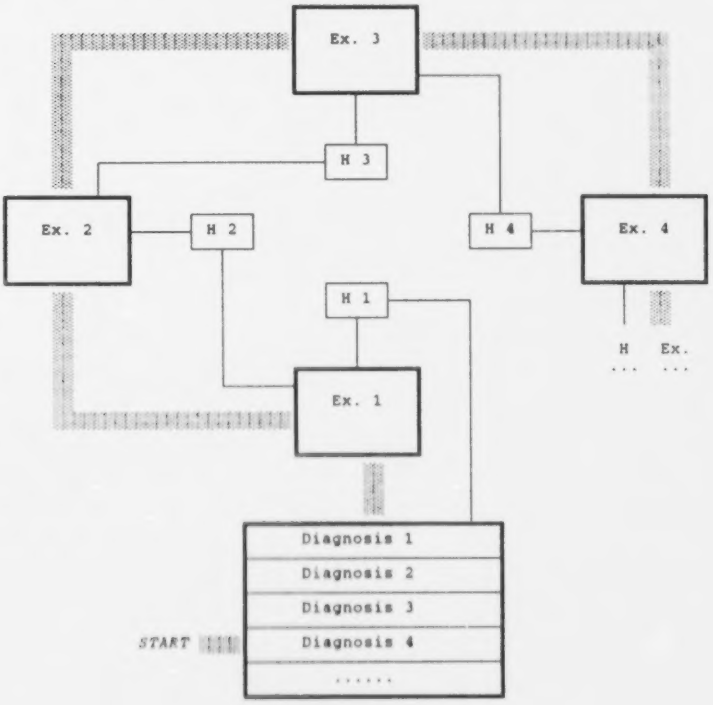
Realistically, one should start by creating self-study materials dealing with a given language problem in such a way that an exercise contains a set of different types of modules with various levels of difficulty and various kinds and levels of help provided by the exercise. Such materials would then run along the lines described above and exemplified bu the following figure.

Flexible Exercise Path (example 1)



We are currently working on a self-study package for business English, which is intended to function as a back-up to the rather limited number of course hours most business persons are able to attend. We are thinking of creating two types of flexible path within these packages.

Flexible Exercise Path (example 2)



Easterbrook / Rüschoff 1987

When working with programmes of this kind, the learner will go through a kind of placement test, examining all aspects of the language problem(s) to be exercised with the package. The result of this diagnosis is stored in the programme, and the route through the set of exercises and additional modules is planned accordingly.

If the pre-exercise needs analysis shows that a learner does not seem to have any significant problems with any of the language problems to be practised, the programme will simply follow the standard course through the exercise as indicated by the thick shaded path. If, however, the diagnosis shows that e.g. in a set of exercises dealing with the English tense system, a learner has no particular problems with the verb tenses and their grammatically correct forms as such, but his/ her knowledge of the use of the tenses in main clauses and related subordinate clauses focused on in ex. 3 appears to be rather shaky, the programme would automatically lead the learner directly through ex.1 and ex.2 as a sort of general revision, but then switch to H 3, representing a preparatory module with a revision exercise of the basic rules concerning this problem before letting him/her work on the actual exercise ex.3.

Of course, the main exercise should not neglect some of the basic criteria for CALL materials of this kind, i.e. learners have to be permitted to flip back and forth through the tasks and possibly allowed to stop working on the exercise in order to check through reference materials provided by the package etc, but in general the degree of help and feedback provided by the programme will be much less in comparison with the preparatory modules.

Another example would be that the main course through the programme consists of exercises in an exploratory mode, such as Wida Software's TESTMASTER, and that the preparatory modules would represent straightforward tutorials going through the items and language problems needed to make best use of the freedom and flexibility provided by the exploratory exercise. In this case the role of the diagnosis would be to determine whether the learner's command of certain aspects of the target language is sufficient to enable him/her to work on the more complex tasks of a flexible response exercise of the TESTMASTER type. In addition to the role mentioned here, in such cases the diagnosis would have to be geared towards an analysis of the student's learning styles, e.g. possible tendencies towards serialistic or holistic learning (cf. O'Shea & Self, 1983, p 56), in order to determine whether a more tutorial or a more exploratory path through a set of exercise modules appears to be more appropriate.

Both pre-exercise needs analysis and permanent needs/ performance analysis are going to be integral parts of the package we are working on at the moment. The main problem our work is now concentrating on is, of course, how to equip the package with the capability of interpreting in order to ensure a meaningful needs analysis. I have in the past already referred to the MINNESOTA ADAPTIVE INSTRUCTIONAL SYSTEM, which includes some interesting

aspects we are going to consider more intensively. (cf. Tennyson, Christensen and Park, 1984) The MAIS system is of particular interest to us, as it is one of the few practical demonstrations of some of the characteristics of intelligent tutorial systems we intend to incorporate in our software. (cf. Breuer, 1986, p 340)

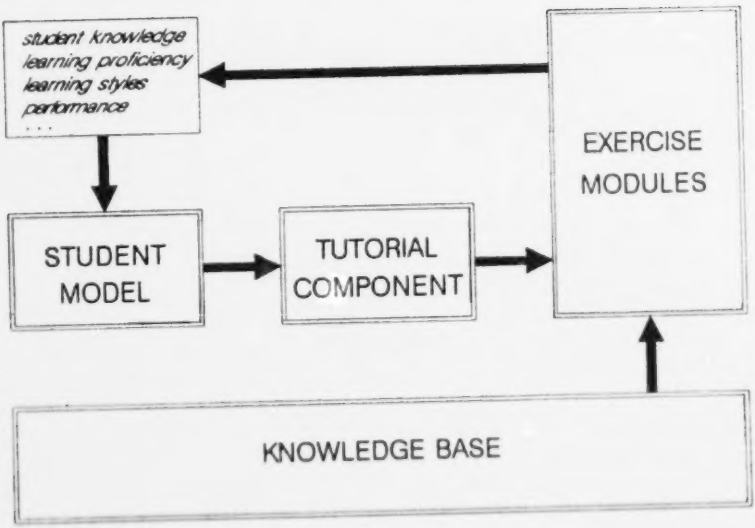
III SELF-DETERMINATION

Thus far I have talked about adaptive programmes with a flexible exercise path determined more or less exclusively by the programme itself. In the past, however, the problem of whether any changes in a programme's structure, sequence or content should be initiated automatically by the programme, or whether the learner should be allowed to decide on, or influence such changes has led to some controversy. It has often been said that the first option would seem to be the more appropriate choice from the point of view of learning psychology. In this way the learner would not notice how he/she is being helped, which may have a positive effect on his/her learning. (cf. Hope et al., 1985, p 47)

However, in 1983 O'Shea and Self reported on various researchers working on "intelligent" tutorial systems who support the argument "... that the learner himself is the best judge of appropriate instructional actions and that the extra responsibilty should help increase his motivation." (O'Shea and Self, 1983, p 159) Our observations mentioned above indicate that, while learners certainly have to learn how to become good judges of appropriate instructional actions, they certainly seem to work more productively when given at least a minimum level of flexibility.

Consequently, I tend to agree with Rex Last, who points out that a possible positive effect of automatic changes in a programme on someone's learning "... can be set against the motivational impact of putting a measure of control into the hands of the learner." (Last, 1984, p 47) It is also my feeling that this may well contribute to the effectiveness of CALL materials for self-study, because it ensures a certain amount of learner autonomy when working with such materials. This is of particular importance in adult education, because, as was stated by Knowles (1980), self-directedness is something towards which adults seem to constantly develop, as it seems to be part of their nature.

It might be interesting in this context ot look at Mandi and Hron's definition of an "intelligent" tutorial system, which has to be both adaptive and flexible. (cf. Mandi and Hron, 1986, p 360) According to them, the "... basic components of such systems must be considered the knowledge base, the student model and the tutorial component." (Mandi and Hron, 1986, p 358) I have tried to exemplify this concept by the following figure.


student knowledge
learning proficiency
learning styles
performance
. . .
EXERCISE MODULES
STUDENT MODEL
TUTORIAL COMPONENT
KNOWLEDGE BASE

The knowledge base refers to the actual content of a set of exercise modules, the student model can be seen as a dynamic representation of a learner's knowledge, performance, learning style and level of comprehension. Finally, the tutorial component guides the learner through the set of curricular modules on the basis of the student model.

In this concept, the term adaptive refers to the fact that course, content and exercise type are always matched with the actual knowledge, performance and learning proficiency of a student. Their understanding of the term flexible, however, includes the fact that a learner has the choice to change the form of presentation and exercise type as well as to make use of additional help options provided by a package on his/her own initiative. Furthermore, one of the main characteristics of computers as learning tools mentioned most often is the fact that computers supposedly "... facilitate autonomous learning: students can, ideally, learn whatever, whenever (soon wherever) they wish." (O'Shea and Self, 1983, p 58)

The main problem, however, "... is not learner control versus no learner control but how to help students optimize the use of learner control available to them." (Merril, 1980, p) Learner control, ie autonomy and self-directedness, is something that has to be developed in students. It seems to be particularly adults who have great difficulty when faced with the task of learning a new language from scratch or taking a refresher course after many years of absence from a (language) classroom. And, as we were able to observe when running a one year beginners English course at the Wuppertal local council adult education department, this applies just as much to the use of CALL programmes in such groups.

The proper use of a certain degree of freedom ideally provided by flexible and adaptive CALL programme is something that does not come naturally. Just as teachers have to learn how to make the best use of computers in language learning, learning with CALL software has to be learned. The fact that computer assisted language learning programmes provide the learner with some kind of feedback and a means of keeping track of his/her performance by some sort of evaluation routine does not mean that other problems of autonomous learning, such as setting up a proper course plan with appropriate stages and selecting the right kind of exercise or activity at the proper moment in the course etc, are no longer relevant.

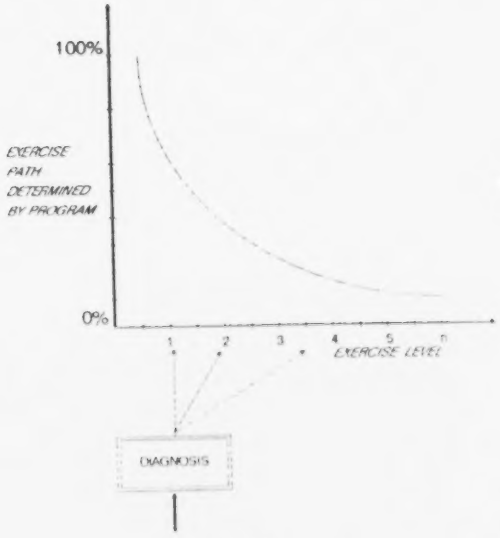
"The learner will begin to achieve autonomy only when he or she feels able to take the initiative in the pedagogical dialogue or interaction that underlies the learning process, whether that dialogue/interaction is conducted with a teacher ... or in a private set of learning materials." (Little, 1987, p 16) Consequently, CALL packages of the kind referred to in this paper should gradually increase the amount of learner control over what is going to be learned and how.

The ability to work in a self-directed manner will also have to be considered as part of the student model mentioned above.

Futhermore, working with a certain exercise module selected by the tutorial component will almost certainly have some effect on the student model, which is why I have attempted to point out a certain circular causality in fig 3. It is, in my opinion the task of a responsible software developer to ensure that this effect is a positive one and to avoid learning patterns of the past being reinforced by simple "drill & kill" programmes, as Chris Jones (1987) sometimes refers to the more traditional CALL programmes. In other words, such sets of exercise modules should incorporate a set of measures intended to further develop a learner's ability to make use of the computer in a responsible, self-directed and, thus, more creative way.

After an initial phase in the early stages of a learning package when less experienced learners need to be provided with exact instructions as to the course, content and learning strategy of a set of exercises, the way in which the learner is presented with more and more options and asked to take a growing number of decisions on his/her own, should be conceived in a way that ensures a gradual change of learning patterns and, as a result, an increased level of autonomy.

DEGREE OF SELF – DETERMINATION



In this kind of set-up, the entry diagnosis should also be directed towards determining the degree of learning proficiency in addition to the appropriate exercise level. With regard to this problem research conducted by Guglielmino (1977), who has developed a Selp-Directed-Learning-Readiness Scale (SDLRS), and by Long and Agyekum (1983), whose investigations according to Caffarella and D'Donnel (1987) support the validity of SDLRS, would have to be looked at more closely. The tutorial component will then also have to "decide" whether the programme should provide more of guided learning or rather allow for a more exploratory style of learning.

At the beginning, a less experienced learner will, of course, have to work with modules which, however adaptive, involve a tutorial component taking most decisions for him/her. Gradually the degree of self-determination increases and more and more modules which allow for more flexibility in the sense mentioned above are presented to the learner. In the same way, the decision taking role of the tutorial component will decrease.

As far as the actual types of module are concerned, which we intend to write for a package of the kind descibed in this paper, we are currently thinking of the following:

(a) straightforward tutorials with help and feedback provided by the exercise on the basis of student performance;

(b) tutorials which simply inform the student as to the correctness of his/her response, but leave it to the student whether or not he/she wishes for further information on mistakes, further help before a new attempt, further information on the subject of the module, or a revision module before returning to the actual exercise;

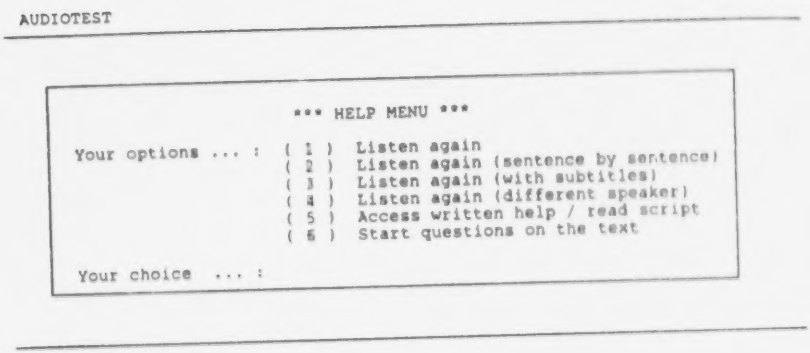
(c) tutorials with an exploratory component which encourage the learner to search for alternative correct solutions in addition to the flexibility as described in (b);

(d) exploratory modules designed along the lines of WIDA Software's TESTMASTER (cf Jones, 1986) which simply provide the learner with a certain frame within which he/she is free to experiment with alternative correct solutions as long and as often as he/she likes;

(e) reference materials and data files with background information which learners can consult at will when working on an exercise package or with other (non-computer based) materials of the curriculum;

(f) routines which present the learner with a video, audiotext or a text on the screen, but leave it to him/her how to approach the "text". The programme simply allows for access to a variety of help features, exercises and tests, which the learner may or may not make use of.

As to the final option listed above, we have developed a listenting comprehension exercise along the lines of an interactive videodisc developed by a team in France (cf Garrigues, 1986) We are using an audiocard, a device installed in the IBM-PC which allows natural sound to be recorded into the computer (either on floppydisk or on harddisk). Any spoken text recorded can be accessed freely at any time of an exercise without any significant delay. Once a learner has listened to a text or dialogue he/she may choose from the following options in order to prepare for the comprehension questions:


AUDIOTEST
*** HELP MENU ***
Your options ... :
(1) Listen again
(2) Listen again (sentence by sentence)
(3) Listen again (with subtitles)
(4) Listen again (different speaker)
(5) Access written help / read script
(6) Start questions on the text
Your choice ... :
Type in the number of your choice - then press ENTER ↵

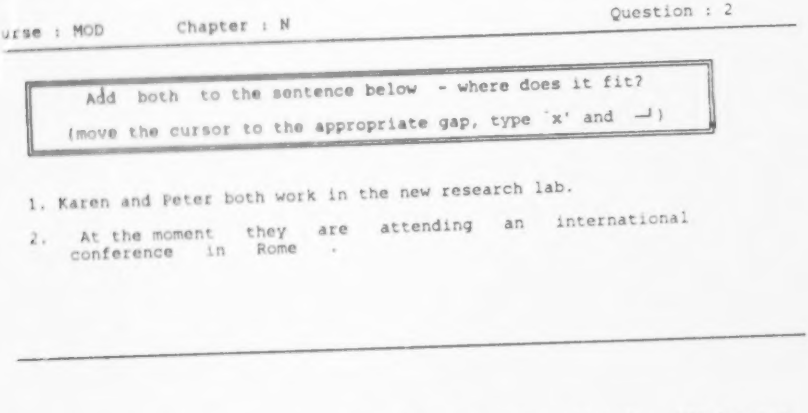
Furthermore, once a learner has started to work on the questions, the programme provides him/her with a set of help options listed at the bottom of the screen.

```
AUDIOTEST                                          question  2  of  4
_____________________________________________________________________

                    A)   He's flying to Paris
                    B)   He has another meeting
                    C)   He's arriving from Paris
                    D)   10 o'clock is too late for him

          Your choice ...: d

_____________________________________________________________________
        Please type in the letter/number of your choice - press ENTER ↵

1=repeat question    2=read/repeat question    3=help/hint    4=written help
```

As with the help menu above, some of the options are only available once a learner has used certain other options or tried to answer a question unsuccessfully. One may only listen to the initial text presented by a different voice or, in the case of the original text being a dialogue, to a narrated version after having used options 1 to 3 (see fig 5). The written help, which is either the script or a description of the content of the original audiotext, is available together with glossary only after a learner has at least attemped to work on the comprehension questions. As said before, we intend to develop similar types of modules using both interactive audio and interactive video materials in addition to text based modules.

Ultimately, the learner should be able to approach a set of exercise and task modules in much the same way as he/she would approach a textbook with lesson texts and tapes, back-up information, exercises for review, practice and self-control etc. All the components needed to achieve a certain goal are laid out before the learner, but how he/she makes use of the set and in which order he/she works his/her way through the materials depends entirely on the individual. It is hoped that at such a later stage the learner will be well prepared to make good use of a by now (hopefully) well developed internal advance organizer and monitor.

We are currently conducting a project in cooperation with IBM Germany using an IBM authoring language called SEF (Self Educational Facility). This authoring language allows us to develop our concept for packages in a way which represents at least one step in the direction described in this paper. While working on an exercise, a learner may constantly access various help options by pressing any of the function keys listed at the bottom of the screen.


urse : MOD Chapter : N Question : 2
Add both to the sentence below - where does it fit?
(move the cursor to the appropriate gap, type 'x' and ↵)
1. Karen and Peter both work in the new research lab.
2. At the moment they are attending an international conference in Rome .
F1=help F2=answer F3=next F4=index F5=joker F6=info F7=glossary

A glossary can be consulted, which allows for the learner to choose from either a paraphrase of the word in question or a different context as well as straight forward translation. Learners can access general information on how to use the flexibility provided by the package and how to handle various technical details. Using the FS-JOKER key, a learner may either consult further background materials and other help relating to the general subject of the exercises or access a notepad facility. In this notepad he/she can enter any comment on the exercise or questions to be discussed with the teacher. The notes are stored and can be printed at the end of the exercise. A third option available is the possibility to stop working with the exercise package with or without a "bookmark". If the learner decides to set exact part of the package the learner was working on before.

IV CONCLUSION

Despite the examples of first practical applications mentioned above and the description of what we intend to develop in the near future, the points I have argued in this paper admittedly remain somewhat theoretical. The main intention of this paper was to point out that apart from the behaviouristic drill and practice exercises of the past there are quite a few "good" traditions of the early days of using (mainframe) computers for learning, and to show how some of the ideas proposed in the past might be applied to computer assisted language learning.

However, much more research is needed into the concept of intelligent tutorial systems and self-directed (language) learning, and it has been stated more than once that the technology as such has developed considerably faster than the various theories of teaching and learning. (cf Breuer, 1986, p 340) O'Shea and Self draw an similar conculsion by saying that "we have seen that improvements in computer technology,..., have not led to significant changes in educational practice." (O'Shea and Self, 1983, p 268)

Furthermore, Caffarella and O'Donnell (1987) have indicated that amongst the many aspects of self-directed learning to be investigated in greater detail more basic research is needed in order to better understand how learners plan and organize their learning. As far as language learning is concerned, we still need to further develop a typology of suitable computer-based exercises and workforms. In addition to this it is necessary to direct more research attention towards the various strategies to be implemented in CALL materials to help learners to achieve a certain level of learning pro-ficiency and autonomy.

Our observations show that it does not suffice to provide learners with a degree of freedom of choice and flexibility in CALL materials. When dealing with inexperienced language learners, the first step has to be to make learners

aware of the fact that there are choices and alternative ways of learning. Appropriate strategies for individualization should be implemented in CALL software for individual study. Futhermore, learners should be "taught" not to expect the computer to automatically work wonders and that letting the computer take all the initiatives and control all learning might not always be the best way of making full use of the potential of computers as learning tools.

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